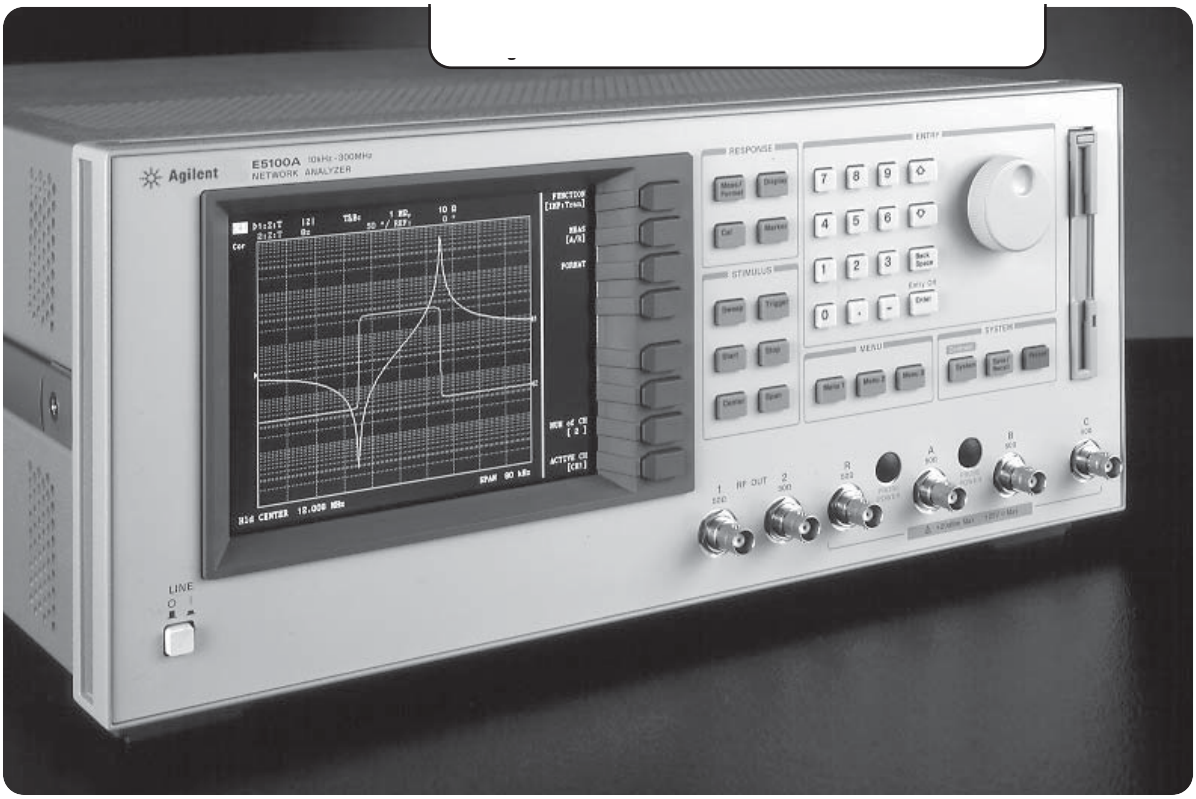
Agilent
E5100A Network Analyzer
10 kHz to 180 MHz/300 MHz

Technical Overview



Agilent's fastest analyzer improves production capability and reduces costs.

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Agilent Technologies

The Agilent Technologies E5100A network analyzer is most appropriately employed on production lines of electronic component manufacturers. They are especially well suited for crystal and ceramic resonator or filter manufacturers. These analyzers improve production line productivity with fast measurement speed, fast waveform analysis commands, and a high-speed processor. They provide faster measurements with lower fluctuations because of their low-noise performance and fine-resolution IFBW.

The E5100A (10 kHz to 180/300 MHz) is a versatile and affordable network analyzer with many functions and options to fit your particular needs with a minimal investment. You can choose the 300 MHz version or the low-priced 180 MHz version.

Major specifications of the E5100A

Frequency range
10 kHz – 180 MHz/300 MHz

Power (One RF OUT)
–48 dBm to +22 dBm (option),
–9 dBm to +11 dBm (standard)

Measurement parameters
Gain (Amplitude Ratio), Phase, Group-Delay, Amplitude, Gain-Phase, Gain-Delay

IFBW
10 Hz – 30 kHz (1,1.5, 2, 3, 4, 5, 8 steps)

Dynamic range
120 dB (1FBW = 1 kHz)

Dynamic accuracy
±0.05 dB, ±0.3 degrees

Measurement speed
0.04 ms/point (IFBW = 30 kHz, Ramp-sweep)

Display
6.5-inch (diag.) color LCD

Programming
Instrument BASIC

Mass storage
FDD and internal non-volatile memory

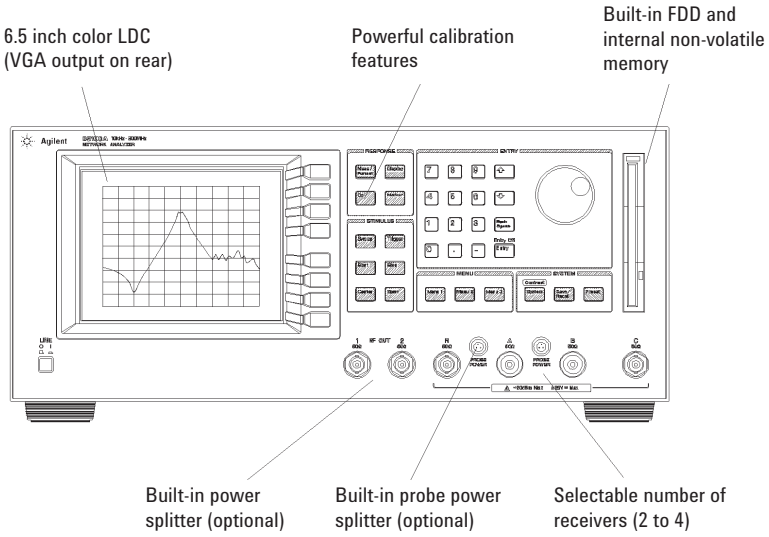
6.5 inch color LDC
(VGA output on rear)
Powerful calibration features
Built-in FDD and internal non-volatile memory
Built-in power splitter (optional)
Built-in probe power splitter (optional)
Selectable number of receivers (2 to 4)

Figure 1. The E5100A analyzers offer 0.4 ms/point measurement speed.

The E5100A adds value to resonator and filter production lines

0.04 ms/point measurement speed
This fast speed increases throughput and reduces testing costs.

Ramp sweep and step sweep
Ramp sweep provides fast measurements without dead-time between points. Step sweep improves accuracy and stability because the analyzer pauses for signal output and receiver settling before making a measurement.

Fine-resolution IFBW
Seven IFBW choices per decade provide the best compromise between measurement time and data stability.

Stable measurements
The low-noise design of the Agilent E5100A allows a 120 dB dynamic range and makes possible low-noise measurements. You get more stable data at wider IFBW settings.

Fast processing
A fast CPU shortens processing time and improves the total throughput. Waveform analysis commands and Instrument BASIC run even faster.

Note: For detailed specifications refer to the E5100A datasheet (publication number 5966-2888E).

Options add capabilities

Selectable number of receivers

The number of receivers on the E5100A can be tailored to your needs so that the best instrument configuration can be chosen for each production line. The E5100A 300 MHz version can have up to 4 receivers; the E5100A 180 MHz version can have up to 3 receivers.

Selectable source output

You can choose single, dual (built-in power splitter), or switched sources outputs.

50 Ω/1 MΩ switchable input impedance

Input impedance of receivers A and B can be changed to 50 Ω/1 MΩ, switchable. 50 Ω fixed configuration is also available.

Supports active probes

Probe power sockets are installed on the front panel. Input connectors on receivers A and B can be changed to type-N for connecting active probes. (Standard is BNC.)

Optical-isolated parallel I/O

A TTL-level parallel interface is standard for interfacing with auto-handlers. For noise immunity, an optical-isolated, open-collector parallel I/O is available.

Small-sized, lightweight

Shorter depth

The E5100A's short depth (425 mm) allows a larger work area in front of the instrument.

Lightweight

Weighing just 12 kg (typical), the analyzers are easy to move when production line layouts change.

Other features

PC-compatible external keyboard and external CRT

The external DIN keyboard and the external display output (VGA) are compatible with popular personal computers.

2-mode DOS floppy disk drive

The built-in FDD supports 2 modes: 720 kbyte (2DD), and 1.44 Mbyte (2HD) DOS formats.

The E5100A—a great fit for productions line final tests

During final tests, both precision and high-speed are required for better yield and better productivity. The Agilent E5100A makes high-quality, high-speed tests with its fine IFBW resolution and low-noise circuitry. Its convenient analysis and processing functions improve the productivity of final-test processes.

Low-cost 180 MHz version

The E5100A 180 MHz version is the economical solution for lower frequency applications. The test frequency range is 10 kHz to 180 MHz. It provides the same measurement performance and measurement speed as the 300 MHz version with lower prices.

Note: The frequency type of the E5100A (180 MHz or 300 MHz) is selected by specifying the receiver options.

Table 1. Comparison of E5100A versions

	E5100A 300 MHz version	**E5100A 180 MHz version**
Test frequency	10 kHz – 300 MHz	10 kHz – 180 MHz
Number of receivers	2 to 4 E5100A-200 E5100A-300 E5100A-400	2 to 3 E5100A-218 E5100A-318
Measurement points	2 to 1601	2 to 1601
List sweep	Yes	Yes
Dynamic range	120 dB	120 dB
Phase tracking DLD function	Yes (E5100A-023)	Yes (E5100A-823)
Evapolation monitor function	Yes (E5100A-022)	No

Resonator tests

High-speed evaluation using waveform analysis commands

The waveform analysis commands of the E5100A perform accurate parameter extraction in a very short time. For example, a single command simultaneously extracts resonant frequency and impedance. The analyzer also has other commands for complex tests of resonators, such as equivalent circuit analysis, peak-search, ripple-analysis, etc. (see Figure 2).

Phase Tracking function improves throughput of DLD measurement

The E5100A network analyzer with Opt.E5100A-823 and E5100A-023 is a good solution for measuring the drive level dependency (DLD) of crystals. This option provides a very quick measurement because it measures only the resonant frequency (Fr) and the resonant impedance (CI) as it sweeps the drive level (see Figure 4).

For crystal resonator tests with a PI network

The E5100A supports high-frequency crystal resonator tests using the 41900A/41901A PI network fixture. The E5100A with Opt. E5100A-618 and E5100A-600 has dual source output ports with different power levels. RF OUT-1 provides higher power for the receiver port A and RF OUT-2 provides lower power for the receiver port R. This capability allows the E5100A to apply a 1-mW drive level (when CI is 25 Ω) even when the PI network test fixture with large attenuation is used. In addition, it is not necessary to connect an external attenuator to the receiver port R.

Accuracy can be increased by eliminating residual impedance and stray admittance around the fixture using the transmission three-term calibration of the E5100A and the furnished calibration kits of the 41900A/41901A. Resonator tests with load capacitors can also be performed with the 41900A/41901A's load capacitor adapter kit.

[Watt] and [Amp] are available to set output power

The drive level of crystal resonators is normally defined as power [Watt] or current [Amp]. The E5100A has a convenient function to set the drive level in Watts or Amperes with nominal crystal impedance. No calculator is needed to convert dBm to Watt or Ampere.

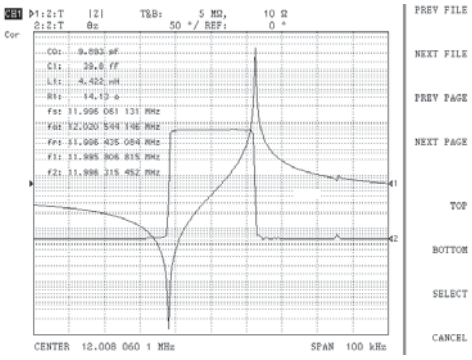

Figure 2. Example of equivalent circuit analysis of a resonator

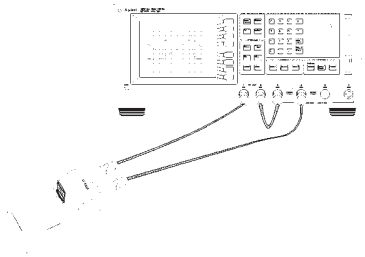

Figure 3. Crystal resonator test with a PI network

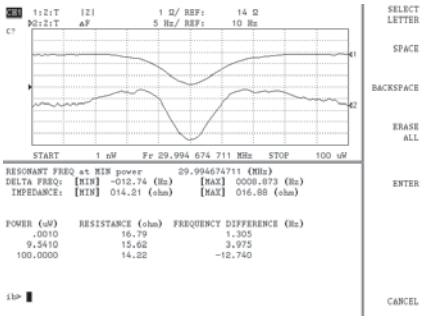
SELECT LETTER
SPACE
BACKSPACE
ERASE ALL
ENTER
CANCEL
START 1 nW Fr 29.994 674 711 MHz STOP 100 uW
RESONANT FREQ at MIN power 29.994674711 (MHz)
DELTA FREQ: [MIN] -012.74 (Hz) [MAX] 0008.873 (Hz)
IMPEDANCE: [MIN] 014.21 (ohm) [MAX] 016.88 (ohm)
POWER (uW) RESISTANCE (ohm) FREQUENCY DIFFERENCE (Hz)
.0010 16.79 1.305
9.5410 15.62 3.975
100.0000 14.22 -12.740

Figure 4. Example of DLD measurement using Opt. E5100A-823 and E5100A-023 phase tracking function

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For filter tests

Effective filter tests using list sweep

The Agilent E5100A's list sweep capability reduces sweep time on filters. The test frequency range of filters varies depending on the rejection band, the pass band, and the user's specifications. The list sweep capability operates over various frequency ranges. The sweep frequency range is separated into segments, each of which can have an independent frequency range, number of sweep points, IFBW, and power level settings. By using list sweep, separate frequency bands can be measured in one sweep, or a different IFBW can be set for pass band and rejection band. Wide dynamic range measurements can be completed less time.

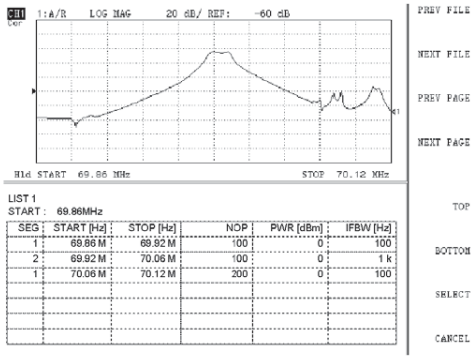

Figure 5. Example of list sweep for filter test

Efficient spurious detection

When detecting high-Q spurs, narrow-span sweeps are necessary after wide-span sweeps, but changing the span degrades the test throughput. The E5100A's short setup changing time improves test efficiency (see Figure 6).

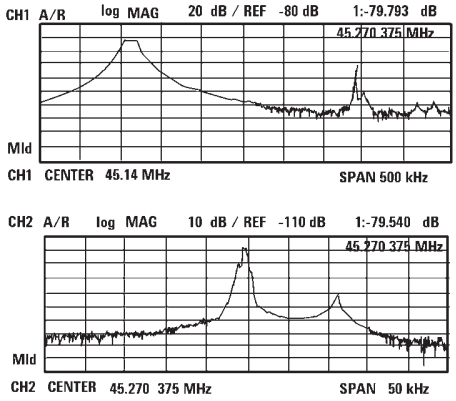
CH1 A/R log MAG 20 dB / REF -80 dB 1:-79.793 dB
45.270 375 MHz
Mld
CH1 CENTER 45.14 MHz
SPAN 500 kHz
CH2 A/R log MAG 10 dB / REF -110 dB 1:-79.540 dB
45.270 375 MHz
Mld
CH2 CENTER 45.270 375 MHz
SPAN 50 kHz

Figure 6. Spurious measurement results (top: wide span, bottom: narrower span)

Quick and easy filter parameter extraction

The E5100A can analyze data quickly using the built-in waveform analysis commands. These commands provide parameters within the pass band (such as insertion loss, 3 dB bandwidth) or parameters within the rejection band. Many commands for analyzing pass-band ripple or group-delay time are also available (see Figure 7).

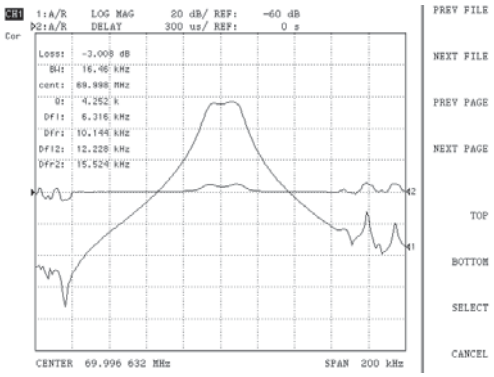

Figure 7. Built-in waveform analysis

Improving filter adjustment productivity
When manually adjusting filters, the E5100A's quick display of the filter response (waveform) and pass/fail results improve productivity. An external VGA monitor can be connected to the analyzer for an even larger display that reduces operator fatigue.

For in-process testing of filters and resonators

For blank crystal tests
The demand for higher-frequency crystal components is growing, which means blank crystals are thinner. When an oscillator and a frequency counter are used to test these higher-frequency crystals, the results aren't accurate. The E5100A's fast measurement speed of 0.04 ms/pt and fast waveform analysis commands improves crystal test productivity.

For vacuum evaporation testing (frequency adjustment) of crystals
The E5100A is an ideal process-monitoring tool for the vacuum evaporation process of crystal resonators and filers. It outputs information necessary to control the process in a real-time manner, so evaporation chamber throughput and adjustment accuracy can be improved. Option E5100A-022, the evaporation monitoring function, is a good solution for adjustment of crystal resonators.

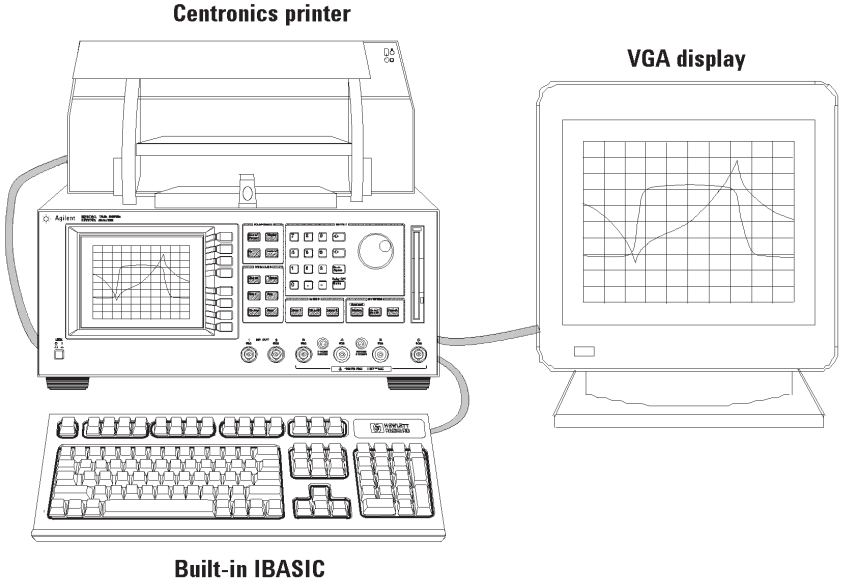

Figure 8. An external monitor can be used to reduce operator eye strain and fatigue.

For other applications

Incoming inspection
The Agilent E5100A can be used for incoming inspection of filters and resonators. When inspecting many kinds of devices, the built-in floppy disk drive and non-volatile-memory are useful for saving and recalling test conditions, calibration data, and test data.

Adjustments of active components and electronic circuits
The E5100A's fast sweep allows rapid adjustments of filter circuitry or active devices such as amplifiers or modulators.

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Ordering Information

Agilent E5100A network analyzer

Furnished accessory

Power cable

Configuration guide

Choose option group <A> or <B>, depending on your measurement needs. Then choose the appropriate options within the chosen group. Lastly, choose the appropriate options from the option group <C>.

- ❍ Choose ONE and ONLY one (Options are mutually exclusive)
- ❑ Choose any combination

<A> For crystal resonator test function

- ❍ E5100A-600 300MHz X'tal resonator test w/PI-network
- ❍ E5100A-618 180MHz X'tal resonator test w/PI-network

<B> For generic test (including ceramic resonator test, filter test) function

For an RF out port option

- ❍ E5100A-001 One RF OUT port
- ❍ E5100A-002 Two RF OUT ports, built-in power splitter
- ❍ E5100A-003 Two RF OUT ports, switched single output
- ❍ E5100A-801 Power extended one RF OUT port
- ❍ E5100A-802 Power extended Two RF OUT ports, built-in power splitter
- ❍ E5100A-803 Power extended Two RF OUT ports, switched single output

1. Manual is not furnished as standard. (add)

For a number of ports option

- ❍ E5100A-200 300MHz, 2 receivers, ports R and A
- ❍ E5100A-218 180MHz, 2 receivers, ports R and A
- ❍ E5100A-300 300MHz, 3 receivers, ports R, A and B
- ❍ E5100A-318 180MHz, 3 receivers, ports R, A and B
- ❍ E5100A-400 300MHz, 4 receivers, ports R, A, B and C

For a connector type option

- ❍ E5100A-701 Type-BNC 50 Ω input connector on port A
- ❍ E5100A-702 Type-BNC 50 Ω input connector ports A and B
- ❍ E5100A-703 Type-BNC 50/1 M Ω selectable input on port A
- ❍ E5100A-704 Type-BNC 50/1 MΩ selectable input on port A and B
- ❍ E5100A-705 Type-N 50 Ω input connector on port A
- ❍ E5100A-706 Type-N 50 Ω input connectors, ports A and B
- ❍ E5100A-707 Type-N 50/1 MΩ selectable input on port A
- ❍ E5100A-708 Type-N 50/1 MΩ selectable inputs, port A and B

Note: Options E5100A-701, 703, 705, and 707 are for Options E5100A-200 and 218 only. Options E5100A-702, 704, 706, and 708 are for Options E5100A-300, 318 and 400 only. Options E5100A-703, 704, 707, and 708 cannot be ordered with Option E5100A-003 or 803.

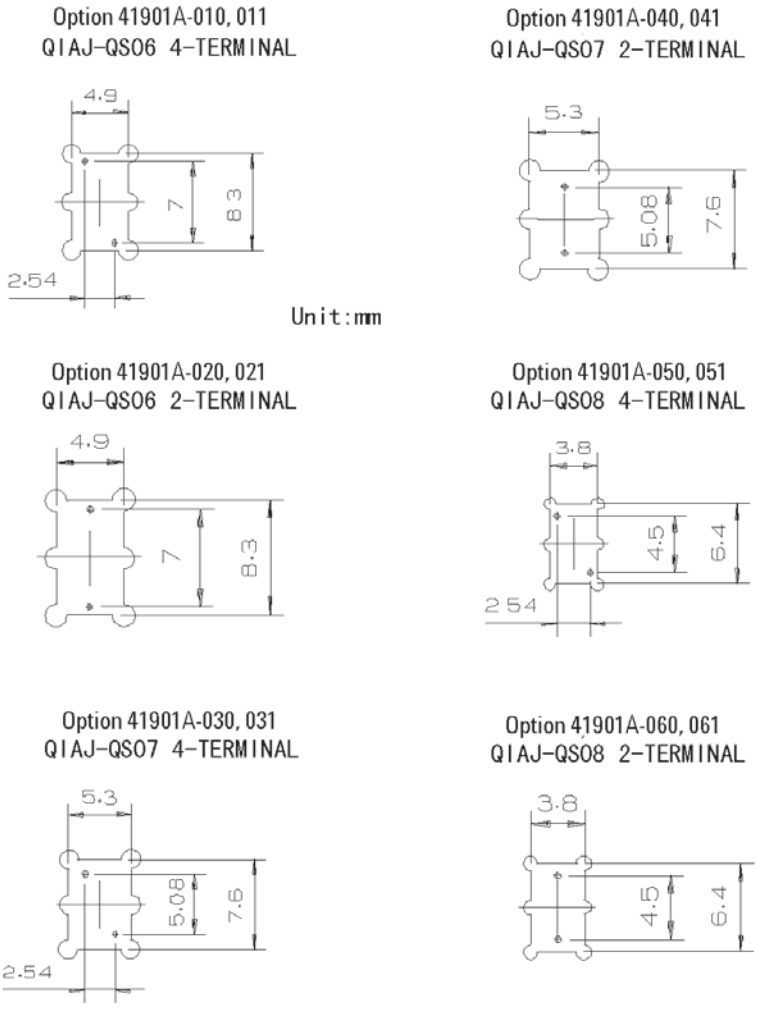

Figure 9. Applicable DUT size and contact pin position of 41901A

<C> For common functions step

For a special measurement function option

- ❑ E5100A-022 Evaporation monitoring function (300 MHz option only)
- ❑ E5100A-023 Phase tracking function for 300 MHz ver.
- ❑ E5100A-823 Phase tracking function for 180 MHz ver.

Note: Option E5100A-022 is for Options E5100A-200, 300, 400, and 600 only. Option E5100A-023 is for Options E5100A-200, 300,400,and 600 only and can't order with Option E5100A-823. Option E5100A-823 is for Options E5100A-218, 318, and 618 only and can't order with Option E5100A-023.

For an I/O option

- ❍ E5100A-804 Parallel I/O standard
- ❍ E5100A-005 Parallel I/O mode A (8 bit I/O)
- ❍ E5100A-006 Parallel I/O mode B (24 bit I/O)
- ❍ E5100A-007 Opto-isolated parallel I/O (24 bit I/O)

For a frequency reference option

- ❍ E5100A-800 Standard frequency reference
- ❍ E5100A-1D5 High stability frequency reference

For the IBASIC option

- ❑ E5100A-UKR Delete instrument BASIC

For a PC style keyboard

- ❑ E5100A-1F0 PC style keyboard -U.S. version

For a rack mount accessories

- ❑ E5100A-1CM Rackmount kit
- ❑ E5100A-1CN Handle kit
- ❑ E5100A-1CP Rackmount and handle kit

For a language of the manual[1]

- ❑ E5100A-ABA U.S. - English localization
- ❑ E5100A-ABJ Japan - Japanese localization
- ❑ E5100A-0BW Add service manual

Accessories

- ❑ 41800A Active probe
- ❑ 41802A 1 MΩ input adapter

41900A PI-network test fixture

- ❑ Option 41900A-001 Variable CL adapter kit

41901A SMD PI-network test fixture

Fixed CL adapter options[1]

- ❑ Option 41901A-010 Attachment kit QIAJ-QS06 4-terminal type (fixed)
- ❑ Option 41901A-020 Attachment kit QIAJ-QS06 2-terminal type (fixed)
- ❑ Option 41901A-030 Attachment kit QIAJ-QS07 4-terminal type (fixed)
- ❑ Option 41901A-040 Attachment kit QIAJ-QS07 2-terminal type (fixed)
- ❑ Option 41901A-050 Attachment kit QIAJ-QS08 4-terminal type (fixed)
- ❑ Option 41901A-060 Attachment kit QIAJ-QS08 2-terminal type (fixed)

Variable CL adapter options[2]

- ❑ Option 41901A-011 Attachment kit QIAJ-QS06 4-terminal type (variable)
- ❑ Option 41901A-021 Attachment kit QIAJ-QS06 2-terminal type (variable)
- ❑ Option 41901A-031 Attachment kit QIAJ-QS07 4-terminal type (variable)
- ❑ Option 41901A-041 Attachment kit QIAJ-QS07 2-terminal type (variable)
- ❑ Option 41901A-051 Attachment kit QIAJ-QS08 4-terminal type (variable)
- ❑ Option 41901A-061 Attachment kit QIAJ-QS08 2-terminal type (variable)

- ❑ 87512A Transmission/ reflection test kit
- ❑ 11850C 50 Ω three-way power splitter

1. These options include a contact board, 22 fixed CL boards, a device positioner and calibration standard (short and 50 Ω).

2. These options include a variable CL board and SMD capacitors. They don't include a contact board, so this option should be ordered with the correspond option from Option 41901A-010 to 41901A-060.

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Agilent
E5100A Network Analyzer

Data Sheet

These specifications are the performance standards or limits against which the instrument is tested. When shipped from the factory, the E5100A meets the specifications listed in this section.

Values followed by (SPC) are supplemental performance characteristics.

Source

Frequency characteristics

Range 10 kHz to 300 MHz

Accuracy (at 23 ±5 °C) . . . . . ±20 ppm

With Option E5100A-1D5 (at 0 to 55 °C, 20 minutes after power on) . ±1 ppm

Stability (at 23 ±5 °C) . . . . . .±5 x 10^{-6}/day (SPC)

With Option E5100A-1D5 (48 hours after power on) ±2.5 x 10^{-9}/8 hours (SPC)

Resolution . . . . . 1 mHz

Output power characteristics

(measured at RF OUT 1, RF OUT 2 is terminated with 50 Ω termination)

Range (nominal)

With Option E5100A-001 . . . . . –9 dBm to +11 dBm

With Option E5100A-002 . . . . . –15 dBm to +5 dBm

With Option E5100A-003 . . . . . –12 dBm to +8 dBm

With Option E5100A-801 . . . . . –48 dBm to +22 dBm

With Option E5100A-802 . . . . . –54 dBm to +16 dBm

With Option E5100A-803 . . . . . –51 dBm to +19 dBm

With Option E5100A-600 (at RF OUT 1) . . . . . –52 dBm to +18 dBm

With Option E5100A-600 (at RF OUT 2) . . . . . –65 dBm to +5 dBm

Resolution . . . . . 0.1 dB

Level accuracy (at 23 ±5 °C, 0 dBm output level, 50 MHz) . . . . . ±1 dB

Flatness (at 23 ±5 °C, relative to 0 dBm output level at 50 MHz) . . +2 dB, –4 dB

With Option E5100A-803 . . . . . +2.5 dB, –4.5 dB

With Option E5100A-801 or E5100A-802
10 kHz ≤ frequency < 50 kHz . . . . . +1.5 dB, –6 dB (SPC)
50 kHz ≤ frequency ≤ 100 MHz . . . . . +2.5 dB, –4.5 dB
100 MHz < frequency ≤ 300 MHz . . . . . +3 dB, –5 dB
With Option E5100A-600
10 kHz ≤ frequency < 50 kHz . . . . . +1.5 dB, –7 dB (SPC)
50 kHz ≤ frequency ≤ 100 MHz . . . . . +2.5 dB, –4.5 dB
100 MHz < frequency ≤ 300 MHz . . . . . +3 dB, –5 dB

Linearity (at 23 ±5 °C, relative to 0 dBm output level at 50 MHz) . . . . . ±1 dB
With Option E5100A-801/802/803
Maximum power level –70 dB ≤ power level
< maximum power level –60 dB . . . . . ±1.5 dB
Maximum power level –60 dB ≤ power level
≤ maximum power level . . . . . ±1 dB

Power splitter

(When the analyzer is equipped with Option E5100A-001 or E5100A-003, delete this section.)

Insertion loss (When the analyzer is equipped with Option E5100A-600, delete this item.) . . . . . 6 dB (nominal)

Output tracking
Without Option E5100A-600
10 kHz ≤ frequency ≤ 100 MHz . . . . . 0.1 dB (SPC)
100 MHz < frequency ≤ 300 MHz . . . . . 0.2 dB (SPC)
With Option E5100A-600
10 kHz ≤ frequency ≤ 100 MHz . . . . . 13 dB ±0.3 dB (SPC)
100 MHz < frequency ≤ 300 MHz . . . . . 13 dB ±0.5 dB (SPC)

Equivalent output SWR
Without Option E5100A-600
10 kHz ≤ frequency < 100 MHz . . . . . ≤ 1.2 (SPC)
100 MHz ≤ frequency ≤ 300 MHz . . . . . ≤ 1.4 (SPC)
With Option E5100A-600
10 kHz ≤ frequency < 50 kHz . . . . . ≤ 2.5 (SPC)
50 kHz ≤ frequency ≤ 100 MHz . . . . . ≤ 1.2 (SPC)
100 MHz < frequency ≤ 300 MHz . . . . . ≤ 1.4 (SPC)

Spectral purity characteristics

Non–harmonic spurious signals (at < 300 MHz)
With Option E5100A-001 (at –4 dBm output level) . . . . . < –45 dBc
With Option E5100A-002 (at –10 dBm output level) . . . . . < –45 dBc
With Option E5100A-003 (at –7 dBm output level) . . . . . < –45 dBc

With Option E5100A-600 (at 0 dBm output level) . . . . . < –45 dBc
With Option E5100A-801 (at +6 dBm output level) . . . . . < –45 dBc
With Option E5100A-802 (at 0 dBm output level) . . . . . < –45 dBc
With Option E5100A-803 (at +3 dBm output level) . . . . . < –45 dBc

Phase noise (at 10 kHz offset from 0 dBm fundamental) . . . . . < –90 dBc/Hz

Other source information

Reverse power protection . . . . . 20 dBm, 25 Vdc (SPC)
Output connector . . . . . BNC female
Output impedance . . . . . 50 Ω (nominal)

Receiver

Input characteristics

Frequency range . . . . . 10 kHz to 300 MHz
1 MΩ input for Options E5100A-703/704/707/708 . . . . . 10 kHz to 5 MHz
IF bandwidth (IF BW) . . . . . 10 Hz to 30 kHz, 1, 1.5, 2, 3, 4, 5, 8 step (nominal)
Impedance . . . . . 50 Ω (nominal)
1 MΩ input for Option E5100A-703/704/707/708 . . . 1 MΩ // 30 pF (nominal)
Return loss (at 50 Ω input)
10 kHz ≤ frequency < 100 MHz . . . . . 20 dB (SPC)
100 MHz ≤ frequency ≤ 300 MHz . . . . . 15 dB (SPC)

Maximum input level

50 Ω input

Frequency	RF attenuator	Maximum input level
10 kHz ≤ frequency < 200 kHz	25 dB	0 dBm
10 kHz ≤ frequency < 200 kHz	0 dB	– 25 dBm
200 kHz ≤ frequency ≤ 300 MHz	25 dB	+5 dBm
200 kHz ≤ frequency ≤ 300 MHz	0 dB	– 20 dBm

1 MΩ Input for Options E5100A-705/706/707/708

Frequency [1]	RF attenuator	Maximum input level
10 kHz ≤ frequency < 200 kHz	25 dB	0.22 Vrms
10 kHz ≤ frequency < 200 kHz	0 dB	0.013 Vrms
200 kHz ≤ frequency ≤ 300 MHz	25 dB	0.40 Vrms
200 kHz ≤ frequency ≤ 300 MHz	0 dB	0.022 Vrms

1. Measurement frequency ≤ 5 MHz

Damage level

DC . . . . . 25 Vdc
AC . . . . . 20 dBm

Averaging noise level (at magnitude measurement, 23 ±5 °C, RF attenuator: 0 dB, 50 Ω input)[1]

IF BW 30 kHz (at > 1 MHz) . . . . . –100 dBm
IF BW 10 kHz (at > 300 kHz) . . . . . –105 dBm
IF BW 3 kHz (at > 100 kHz) . . . . . –110 dBm
IF BW 1 kHz
30 kHz ≤ frequency < 100 kHz . . . . . –95 dBm
100 kHz ≤ frequency ≤ 300 MHz . . . . . –115 dBm
IF BW 300 Hz
10 kHz ≤ frequency < 100 kHz . . . . . –100 dBm
100 kHz ≤ frequency ≤ 300 MHz . . . . . –120 dBm
IF BW 100 Hz
10 kHz ≤ frequency < 100 kHz . . . . . –105 dBm
100 kHz ≤ frequency ≤ 300 MHz . . . . . –125 dBm

Input crosstalk (When the analyzer is equipped with Option E5100A-100, delete this section.) Reference input (0 dBm input level at 10 kHz to 200 kHz and +5 dBm input level at 200 kHz to 300 MHz, RF attenuator: 25 dB, 50 Ω input)
Test input (RF attenuator: 0 dB, terminated with 50 Ω termination)

10 kHz ≤ frequency < 100 kHz . . . . . < –110 dB
100 kHz ≤ frequency ≤ 300 MHz . . . . . < –120 dB

Source crosstalk
(all RF OUT and input connectors are terminated with 50 Ω terminations)

Without Option E5100A-801/802/803 (at +5 dBm output level, RF attenuator: 0 dB, 50 Ω input)
10 kHz ≤ frequency < 100 kHz . . . . . < –110 dB (SPC)
100 kHz ≤ frequency < 250 MHz . . . . . < –125 dB (SPC)
250 MHz ≤ frequency ≤ 300 MHz . . . . . < –120 dB (SPC)
With Option E5100A-801/802/803 (at +16 dBm output level, RF attenuator: 0 dB, 50 Ω input)
10 kHz ≤ frequency < 100 kHz . . . . . < –120 dB (SPC)
100 kHz ≤ frequency < 250 MHz . . . . . < –135 dB (SPC)
250 MHz ≤ frequency ≤ 300 MHz . . . . . < –130 dB (SPC)

1. When the analyzer frequency is identical to the transmitted interference signal frequency, refer to "EMC" in "general characteristics."

Residual response

(RF attenuator: 0 dB, except for the following points) . . . . . < –80 dBm
50 kHz, 100 kHz, 95.825 MHz, 95.875 MHz,159.791667 MHz, 159.825 MHz, 159.841667 MHz, 159.875 MHz, 239.75 MHz, and 239.875 MHz

Input connector . . . . . BNC female

With Option E5100A-705/706/707/708 . . . . . BNC female, Type-N female (for A, B inputs)

Measurement mode

With Option E5100A-100 . . . . . A

With Option E5100A-200 or E5100A-600 . . . . . A/R, R/A, R, A

With Option E5100A-300 . . . . . A/R, B/R, R/A, B/A, R/B, A/B, R, A, B

With Option E5100A-400 . . . . . A/R, B/R, C/R, R/A, B/A, C/A, R/B, A/B, C/B, R/C, A/C, B/C, R, A, B, C

(When the measurement mode is either R/A, B/A, C/A, R/B, A/B, C/B, R/C, or A/C, the specification is SPC.)

Magnitude characteristics

Absolute characteristics

Absolute amplitude accuracy

(at 23 ±5 °C, –30 dBm input level for RF attenuator: 0 dB or –5 dBm input level for RF attenuator: 25 dB, 50 Ω input)

±1 dB

Ratio characteristics

Frequency response[1]

(at 23 ±5 °C, –30 dBm input level for RF attenuator: 0 dB or –5 dBm input level for RF attenuator: 25 dB, the same RF attenuator setting for both inputs)

50 Ω input

10 kHz ≤ frequency < 100 kHz . . . . . ±1 dB

100 kHz ≤ frequency ≤ 100 MHz . . . . . ±0.5 dB

100 MHz < frequency ≤ 300 MHz . . . . . ±1 dB

1 MΩ input for Option E5100A-703/704/707/708

(using 50 Ω feedthrough) . . . . . ±3 dB

1. Frequency response can be improved by calibration.

Dynamic accuracy
(at 23 ±5 °C, 10 Hz IF BW, –10 dBm reference input level relative to maximum input level, –20 dBm test input level relative to maximum input level, except for ramp frequency sweep)

Test channel input level RF attenuator		Dynamic accuracy frequency	
25 dB	0 dB	Other	10 kHz to 50 kHz
+5 to –5 dBm[1]	–20 to –30 dBm[2]	±0.4 dB	±0.4 dB (SPC)
–5 to –15 dBm	–30 to –40 dBm	±0.09 dB	±0.09 dB (SPC)
–15 to –45 dBm	–40 to –70 dBm	±0.05 dB	±0.05 dB (SPC)
–45 to –55 dBm	–70 to –80 dBm	±0.06 dB	±0.1 dB (SPC)
–55 to –65 dBm	–80 to –90 dBm	±0.1 dB	±0.3 dB (SPC)
–65 to –75 dBm	–90 to –100 dBm	±0.3 dB	±0.9 dB (SPC)
–75 to –85 dBm	–100 to –110 dBm	±0.9 dB	±3 dB (SPC)
–85 to –95 dBm	–110 to –120 dBm	±3 dB	N/A

With Option E5100A-100
(at 23 ±5 °C, 10 Hz IF BW, –20 dB input-A level relative to maximum input level, except for ramp frequency sweep, right after measuring reference)

Test channel input level RF attenuator		Dynamic accuracy frequency	
25 dB	0 dB	Other	10 kHz to 50 kHz
+5 to –5 dBm[1]	–20 to –30 dBm[2]	±0.4 dB	±0.4 dB (SPC)
–5 to –45 dBm	–30 to –70 dBm	±0.1 dB	±0.1 dB (SPC)
–45 to –55 dBm	–70 to –80 dBm	±0.1 dB	±0.2 dB (SPC)
–55 to –65 dBm	–80 to –90 dBm	±0.2 dB	±0.6 dB (SPC)
–65 to –75 dBm	–90 to –100 dBm	±0.6 dB	±1.8 dB (SPC)

Trace noise
(at 1 kHz IF BW, frequency > 305 kHz, –5 dBm input level for RF attenuator: 25 dB or –30 dBm input level for RF attenuator: 0 dB) . . . . . < 10 dBm rms
Stability . . . . . 0.02 dB/°C (SPC)
With Option E5100A-100
(at 23 ±5 °C) . . . . . 0.05 dB/°C (SPC)

1. 0 to –5 dBm at 10 kHz to 200 kHz
2. –25 to –30 dBm at 10 kHz to 200 kHz

Phase characteristics

(When the analyzer is equipped with Option E5100A-100, delete this section.)

Measurement mode . . . . . .Normal/Expanded

Frequency response[1]

(at 23 ±5 °C, –30 dBm input level for RF attenuator:
0 dB or –5 dBm input level for RF attenuator: 25 dB,
the same RF attenuator setting for both inputs, 50 Ω input)

10 kHz ≤ frequency < 100 kHz . . . . . ±5°
100 kHz ≤ frequency ≤ 100 MHz . . . . . +2.5°
100 MHz < frequency ≤ 300 MHz . . . . . ±5°

Dynamic accuracy

(at 23 ±5 °C, 10 Hz IF BW, –10 dBm reference input level relative to maximum input level, –20 dBm test input level relative to maximum input level, except for ramp frequency sweep)

Test channel input level RF attenuator		Dynamic accuracy frequency	
25 dB	0 dB	Other	10 kHz to 50 kHz
+5 to –5 dBm[1]	–20 to –30 dBm[2]	±3°	±3° (SPC)
–5 to –15 dBm	–30 to –40 dBm	±0.6°	±0.6° (SPC)
–15 to –45 dBm	–40 to –70 dBm	±0.3°	±0.3° (SPC)
–45 to –55 dBm	–70 to –80 dBm	±0.3°	±0.6° (SPC)
–55 to –65 dBm	–80 to –90 dBm	±0.6°	±1.8° (SPC)
–65 to –75 dBm	–90 to –100 dBm	±1.8°	±6° SPC)
–75 to –85 dBm	–100 to –110 dBm	±6°	±18° (SPC)
–85 to –95 dBm	–110 to –120 dBm	±18°	NIA

Trace noise

(at 1 kHz IF BW, frequency > 305 kHz, –5 dBm input level for RF attenuator: 25 dB or –30 dBm input level for RF attenuator: 0 dB) . . . . . < 50 mdeg rms

Stability . . . . . 0.15 deg/°C (SPC)

1. This frequency response is only for the deviation from linear phase. Frequency response can be improved by calibration.
2. 0 to –5 dBm at 10 kHz to 200 kHz
3. –25 to –30 dBm at 10 kHz to 200 kHz

Delay characteristics

Aperture frequency . . . . $\frac{200}{N-1}$% to 100% of span, where N is number of points

Accuracy (at 23 ±5 °C, SPC)

In general, the following formula can be used to determine the accuracy, in seconds, of a specific group delay measurement:

$$\frac{\textit{Phase accuracy}\ [\text{deg}]}{360\ [\text{deg}] \times \textit{aperture}\ [\textit{Hz}]}\ (\textit{sec})$$

Depending on the aperture, input level, and device length, the phase accuracy used in either incremental phase accuracy or worst case phase accuracy.

General characteristics

Operating conditions

When disk drive is in operation

Temperature . . . . . 10 to 40 °C

Humidity (at wet bulb ≤ 29 °C, without condensation) . . 15% ≤ RH ≤ 80%

When disk drive is not in operation

Temperature . . . . . 5 to 40 °C

Humidity (at wet bulb ≤ 29 °C, without condensation) . . 15% ≤ RH ≤ 80%

Altitude . . . . . 0 to 2,000 meters

Warm-up time . . . . . 30 minutes

Non-operating conditions

Temperature . . . . . – 20 to 60 °C

Humidity (at wet bulb ≤ 40 °C, without condensation) . . . . 15% ≤ RH ≤ 90%

Altitude . . . . . 0 to 4,572 meters

Safety . . . . . .Certified by CSA-C22.2 No.1010.1-92, Based on IEC 1010-1 (1990) including Amendment 1 (1992)

EMC[1] . . . . . .Complies with CISPR 11(1990)/EN 55011(1991): Group 1, Class A
Complies with IEC 801-2 (1991)/EN 55082-1(1992): 4 kV CD, 8 kV AD
Complies with IEC 801-3 (1984)/EN 55082-1(1992): 3 V/m
Complies with IEC 801-4 (1988)/EN 55082-1(1992):1 kV power lines, 0.5 kV signal lines

Power requirement . . . . . 90 to 132 V or 198 to 264 V, 47 to 63 Hz, 400 VA max

Weight (depending on option) . . . . . 12 kg (SPC)

Cabinet dimensions . . . . . 425(W) x 177(H) x 425(D) mm (SPC)

1. When tested at 3 V/m according to IEC 801-3/1984, the averaging noise level will be within specifications over the full immunity test frequency range of 26 to 1000 MHz except when the analyzer frequency is identical to the transmitted interference signal test frequency.

Supplemental characteristics

Measurement function

Number of measurement channels . . . . . 1 to 4
Display format . . . . . Cartesian
Sweep parameter . . . . . frequency, power
Sweep type
E5100A . . . . . linear (step, ramp), list
Measurement point per sweep
E5100A . . . . . 2 to 1,601

Others

Measurement calibration . . . . Response, response and isolation, 1-port 3-term
Display . . . . . 6.5 inch color LCD, 640 x 480 dots
Flexible disk drive . . . . . 720 Kbytes/1.2 Mbytes/1.44 Mbytes, DOS format, binary or ASCII format
Flash disk . . . . . 256 Kbytes
Ram disk . . . . . 256 Kbytes
Programming . . . . . Instrument BASIC
GPIB . . . . . ANSI/IEEE 488.2 compatible
Parallel I/O port . . . . . 16 bit output, 8 bit input/output, TTL level
Option E5100A-005 . . . . . 8 bit output, 4 bit input, TTL level
Option E5100A-006 . . . . . 16 bit output, 8 bit input/output, TTL level
Option E5100A-007 . . . .16 bit output, 8 bit input, open collector, opto-isolated
Printer . . . . . Parallel I/F (Centronics compatible), HP PCL
Keyboard . . . . . mini-DIN (IBM PC compatible)
External video monitor output . . . . . VGA

Connectors

Probe power . . . +15 V (300 mA max.), –12.6 V (160 mA max.), GND nominal
(the maximum current values are total values of each probe connector)

EXT REF INPUT 10 MHz

Frequency . . . . . 10 MHz ±5 ppm
Amplitude . . . . . 0 ±5 dBm (SPC)
Nominal impedance . . . . . 50 Ω

REF OVEN (OPTION E5100A-1D5)

Frequency (at 0 to 55 °C, 20 minutes after power ON) . . .10 MHz ±1.0 ppm
Amplitude . . . . . 2 ±5 dBm (SPC)
Nominal impedance . . . . . 50 Ω

INT REF OUTPUT

Frequency (at 23 ±5 °C) . . . . . 10 MHz ±20 ppm
Amplitude . . . . . 0 ±5 dBm (SPC)
Nominal impedance . . . . . 50 Ω

EXT TRIGGER and **EXT PROG RUN/CONT**

(Positive edge trigger)

V_{ih} . . . . . +2 V to +5 V (SPC)
V_{il} . . . . . 0 V to +0.5 V (SPC)
Sink current (Is) . . . . . Is ≤ 0.4 mA (SPC)
Pulse width (Tp) . . . . . Tp ≥ 20 µsec (SPC)

Furnished accessories

Accessories	Qty.	Agilent part number
Power cable	1	–
Sample program disk	1	E5100-180X0[1]
CD-ROM (manuals)	1	E5100-905XX[2]
Option E5100A-ABA add manuals		
Function Reference	1	E5100-900X0[2]
Programming Manual	1	E5100-900X7[2]
User's Guide	1	E5100-900X1[2]
Instrument BASIC Users Handbook	1	04155-90150
Instrument BASIC Users Handbook Supplement	1	E5100-900X5[2]
Option E5100A-0BW add Service Manual		
Service Manual	1	E5100-901X0[2]
Option E5100A-1CM rack mount kit		
Front handle kit	1	5062-3978
Option E5100A-1CP front handle kit		
Rack and handle kit	1	5062-3990
Option E5100A-1CP rack and handle kit		
Rack and handle kit	1	5062-3984
Option E5100A-1D5 high stability frequency		
BNC adapter	1	1250-1859
Option E5100A-1F0 external keyboard		
Keyboard	1	–

1. Furnished with special sample program disk (E5100-180X1) as well as the original one if Option E5100A-022/023 is designated. The number indicated by "X" in the part number of the sample program disk, is allocated for numbers increased by one each time a revision is made. The latest edition comes with the product.
2: The number indicated by "X" in the part number of each manual, is allocated for numbers increased by one each time a revision is made. The latest edition omes with the product.